PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-004555
(43)Date of publication of application : 06.01.1999

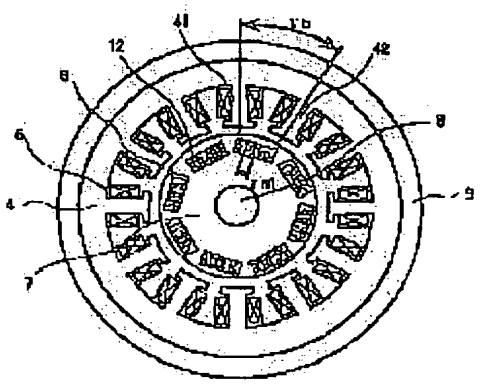
(51)Int.Cl. H02K 1/27

(21)Application number : 09-153276
(22)Date of filing : 11.06.1997

(71)Applicant : HITACHI LTD
(72)Inventor : KAWAMATA SHOICHI
TAJIMA FUMIO
MATSUNOBU YUTAKA
SHIBUKAWA SUETARO
KOIZUMI OSAMU

(54) PERMANENT MAGNET ROTATING MACHINE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a highly efficient permanent magnet rotating machine while reducing an eddy current on the surface of a magnet, by constituting a conductive permanent magnet with a plurality of groups of conductive unit magnet being provided side by side in the peripheral direction of a rotor.
SOLUTION: A permanent magnet rotating machine consists of a stator and a rotor, the stator consists of a stator core 4 and a stator coil winding 5, the rotor is divided into the rotary direction of the rotor, and a conductive permanent magnet 6 being constituted in a group of unit magnets with a magnet width of tm1 is arranged to have each different polarity in a circumferential direction. As a result, the conductive permanent magnet 6 for stator coil winding salient poles 41 and 42 is formed by a plurality of unit magnets, thus reducing the surface area of each unit magnet and increasing electrical resistance. Therefore, an eddy current caused by harmonics magnetic flux cannot flow smoothly and the eddy current loss can also be reduced. Therefore, even if a conductive permanent magnet with a high magnetic flux density is used, a compact, light, and efficient permanent magnet rotating machine can also be obtained.



LEGAL STATUS

[Date of request for examination]	10.12.2001
[Date of sending the examiner's decision of rejection]	04.01.2005
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3690067

[Date of registration]	24.06.2005
[Number of appeal against examiner's decision of rejection]	2005-001777
[Date of requesting appeal against examiner's decision of rejection]	03.02.2005
[Date of extinction of right]	

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Each magnetic pole of said permanent magnet is a permanent magnet dynamo-electric machine characterized by two or more conductive unit magnets being installed by the rotor circumferential direction in the permanent magnet dynamo-electric machine equipped with the stator which has the stator salient pole where the coil was wound, and the rotator which was held pivotable with the rotation opening at this stator, and prepared the permanent magnet in a perimeter or the interior.
[Claim 2] It is the permanent magnet dynamo-electric machine characterized by for each magnetic pole of said permanent magnet having spacing mutually in claim 1 publication, and being annularly installed by the rotor circumferential direction.
[Claim 3] Said unit magnet of the others contained in the magnetic pole with each same magnetic pole of said permanent magnet in claim 2 publication is a permanent magnet dynamo-electric machine characterized by including at least one unit magnet of different magnitude.
[Claim 4] The direction height of a path of said unit magnet which is in a hoop direction center section in claim 3 publication is a permanent magnet dynamo-electric machine characterized by being larger than the direction height of a path of said unit magnet of the others contained in the same unit magnet group.
[Claim 5] It is the permanent magnet dynamo-electric machine characterized by having the insulating material filled up with the opening of a permanent magnet insertion hole with said larger rotator than the magnitude of the rotor circumferential direction cross section of said unit magnet group, said permanent magnet, and said permanent magnet insertion hole in claim 2 publication.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a permanent magnet dynamo-electric machine.
[0002]
[Description of the Prior Art] Lightweight and an efficient thing with a dynamo-electric machine smaller than before are desired. For example, when using for motor car two ways, such as an electric vehicle, the request of economical transit and improvement in the mileage per unit of a dc-battery are desired, and it is required to be efficient for that purpose at a small light weight.
[0003] As an efficient dynamo-electric machine, it is known for the small light weight that the permanent magnet dynamo-electric machine which used the permanent magnet for the magnetic-flux generating means is the optimal.
[0004] Recently, by using a rare earth magnet as a permanent magnet, high flux density is secured and improving effectiveness is planned.
[0005] However, conductivity of a rare earth magnet is high, since resistance is small, it will be easy to generate an eddy current and it will become the cause which lowers effectiveness conversely.
[0006] In order to solve the problem, what decreases the eddy current inside a permanent magnet is indicated by JP,5-227686,A by arranging by turns the conductive high permanent magnet and non-conductive permanent magnet of flux density which are represented by the rare earth magnet to rotator shaft orientations.
[0007]
[Problem(s) to be Solved by the Invention] However, since a technique given in the above-mentioned official report uses a non-conductive permanent magnet for a part, as compared with the case where only a conductive permanent magnet is used, a magnetic utilization factor cannot worsen and it cannot gather effectiveness.
[0008] Moreover, since the above-mentioned technique constitutes a permanent magnet from a dissimilar material, it must constitute a dynamo-electric machine on the basis of the weak ingredient of mechanical strength among two sorts of ingredients, and has the problem that dependability falls.
[0009] While this invention reduces the eddy current on the front face of a magnet in view of the above, it aims at offering the permanent magnet dynamo-electric machine which can attain a well head.
[0010]
[Means for Solving the Problem] The above-mentioned purpose is held pivotable with a rotation opening at the stator which has the stator salient pole where the coil was wound, and this stator, and each magnetic pole of said permanent magnet is attained by the permanent magnet dynamo-electric machine characterized by two or more conductive unit magnets being installed by the rotor circumferential direction in the permanent magnet dynamo-electric machine equipped with the rotator which prepared the permanent magnet in a perimeter or the interior.
[0011]
[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained using

drawing.
[0012] In drawing 1 , the sectional view of a permanent magnet dynamo-electric machine and drawing 2 show the top view of the permanent magnet dynamo-electric machine of drawing 1 , and drawing 3 shows the perspective view of a rotator.
[0013] In addition, as for this operation gestalt, 12 poles and the permanent magnet pole of a rotator can apply this invention also to the thing of other numbers of salient poles, and a pole, although the number of stator winding salient poles is the thing of eight poles.
[0014] In drawing, the permanent magnet dynamo-electric machine 1 consists of a stator 2 and a rotator 3, and a stator 2 consists of a stator core 4 and a stator winding 5.
[0015] The rotator 3 is considered as the configuration arranged so that the conductive permanent magnet 6 which was divided into the hand of cut of a rotator 3, and consisted of unit magnet groups of the magnet width of face taum1 may serve as a polarity which is mutually different in a circumferencial direction.
[0016] That is, the permanent magnet which consisted of unit magnet groups with the polarity of N-S like drawing 3 , and the conductive permanent magnet which consisted of unit magnet groups with the polarity of S-N are inserted in the permanent magnet insertion hole 12 formed in the rotor core 7, is constituted, and is held free [rotation] through a shaft 8 and bearing 10,101 at the end bracket 11,111.
[0017] In addition, although the configuration which has a frame 9 in the periphery of a stator core 4 here showed, a frame may be excluded depending on the need.
[0018] Here, it is taum in the magnet width of face of a unit magnet about spacing of taum1 and the stator winding salient poles 41 and 42. It is taum1 <taum when it carries out. It is carrying out.
[0019] Since the conductive permanent magnet 6 which counters the stator winding salient poles 41 and 42 is formed with two or more unit magnets by considering as such a configuration, the surface area of each unit magnet becomes small, and can enlarge electric resistance. For this reason, the eddy current by higher-harmonic magnetic flux stops being able to flow easily, and loss by the eddy current can also be reduced.
[0020] Therefore, even if it uses a conductive permanent magnet with the high flux density represented by the rare earth magnet, an efficient dynamo-electric machine can be realized and a small lightweight and efficient permanent magnet dynamo-electric machine can be offered.
[0021] In addition, in this example, after the unit magnet of N-S or S-N had a polarity (after magnetization), it considered as the configuration inserted in the permanent magnet insertion hole 12, but after inserting unit magnet material, you may magnetize. In this case, the effectiveness that insertion of unit magnet material improves is acquired.
[0022] Drawing 4 shows other operation gestalten of this invention.
[0023] The difference from the operation gestalt of drawing 2 is in the point that the unit magnet is formed through the insulating material 13.
[0024] Although said insulating material 13 is good also as a configuration inserted between unit magnets, if it is the configuration which fills up one and fixes with a unit magnet by adhesives, resin, etc., the effectiveness as for which fixing of a unit magnet and the configuration of an insulating material 13 are made to coincidence will be acquired.
[0025] According to the above-mentioned configuration, since a unit magnet is insulated with an insulating material 13, an eddy current will not flow between unit magnets and reduction of the further eddy current loss can be aimed at.
[0026] In addition, by the above explanation, although the configuration in restoration by insertion or adhesives showed the insulating material 13, an insulating material 13 may be beforehand formed in a need part by coating etc. at a unit magnet. In this case, since routings, such as restoration by insertion of an insulating material 13 or adhesives, can be skipped, the effectiveness that workability improves is acquired.
[0027] Drawing 5 and drawing 6 show other operation gestalten of this invention.
[0028] The difference from the operation gestalt of drawing 2 is in the point of having made height h of a unit magnet located in the center of a unit magnet group differing from the height h1 and h2 of the unit magnet in the both sides.

[0029] That is, drawing 5 makes small the height h1 of the unit magnet of both ends to height [of two unit magnets of a center section] h, and to height h of the unit magnet of a center section, drawing 6 makes height h1 and h2 small as it goes to an edge.
[0030] According to the above-mentioned configuration, the effectiveness which can form [hemicycle / an abbreviation trapezoid, / abbreviation] the configuration of the conductive permanent magnet 6 easily by selection of height h of a unit magnet is acquired.
[0031] In addition, when not using the conductive high permanent magnet of rare earth etc., an abbreviation trapezoid, an abbreviation hemicycle, etc. can be similarly formed easily by selection of height h of a unit magnet.
[0032] In addition, with the above-mentioned operation gestalt, although the configuration of the magnet insertion opening 13 of a rotor core 7 and the configuration of each unit magnet are mostly make into the shape of isomorphism, insulating space, such as an insulating material 13 or an air space, may be prepare between the permanent magnet insertion hole 12 and a unit magnet as the configuration (this example rectangle) same like drawing 7 and drawing 8 as the permanent magnet insertion hole 12 showed in drawing 3 .
[0033] According to the above configuration, since the amount of magnetic flux of conductive permanent magnet both ends can be controlled, the effectiveness that the cogging torque produced between a stator winding salient pole and a magnet can be reduced is acquired.
[0034] Drawing 9 shows other operation gestalten of the permanent magnet dynamo-electric machine of this invention.
[0035] The difference from drawing 2 is in the point of having made the width of face taum1 of the unit magnet in a center section differing from the width of face taum2 of the unit magnet in both ends.
[0036] That is, drawing 9 makes small taum2 of the unit magnet of both ends to the width of face taum1 of four unit magnets of a center section.
[0037] According to the above-mentioned configuration, the effectiveness that the configuration of the conductive permanent magnet 6 can be brought more close to a trapezoid and a hemicycle by changing the width of face taum1 of a unit magnet with a magnetic location is acquired.
[0038] In addition, although the above explained the configuration of the conductive permanent magnet 6 in the rectangular example, drawing 10 , a radii configuration like drawing 11 , a stellate configuration, etc. do not adhere to especially a permanent magnet configuration.
[0039] Moreover, the same effectiveness is acquired even if it uses it for the thing of a configuration of that a conductive permanent magnet is arranged on the surface of a rotor core.
[0040] Moreover, although the above explained the permanent magnet dynamo-electric machine which has permanent magnet rotator structure, not only a dynamo-electric machine but a generator may be used, and it can apply also to an abduction mold and the dynamo-electric machine using an introvert mold rotator.
[0041] Furthermore, not only a dynamo-electric machine but the application to a linear motor etc. is possible.
[0042]
[Effect of the Invention] An efficient permanent magnet dynamo-electric machine can be obtained reducing the eddy current on the front face of a magnet by constituting a conductive permanent magnet from two or more conductive unit magnet groups.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view of the permanent magnet dynamo-electric machine which makes 1 operation gestalt of this invention is shown.
[Drawing 2] The top view of the permanent magnet dynamo-electric machine of drawing 1 is shown.
[Drawing 3] The perspective view of the permanent magnet rotator of drawing 1 is shown.
[Drawing 4] some permanent magnet dynamo-electric machines which make other operation gestalten of this invention -- a top view is shown.
[Drawing 5] some permanent magnet dynamo-electric machines which make other operation gestalten of this invention -- a top view is shown.
[Drawing 6] some permanent magnet dynamo-electric machines which make other operation gestalten of this invention -- a top view is shown.
[Drawing 7] some permanent magnet dynamo-electric machines which make other operation gestalten of this invention -- a top view is shown.
[Drawing 8] some permanent magnet dynamo-electric machines which make other operation gestalten of this invention -- a top view is shown.
[Drawing 9] some permanent magnet dynamo-electric machines which make other operation gestalten of this invention -- a top view is shown.
[Drawing 10] some permanent magnet dynamo-electric machines which make other operation gestalten of this invention -- a top view is shown.
[Drawing 11] some permanent magnet dynamo-electric machines which make other operation gestalten of this invention -- a top view is shown.
[Description of Notations]
1 [-- A stator core, 5 / -- A stator winding, 6 / -- A conductive permanent magnet, 7 / -- A rotor core, 8 / -- A shaft, 9 / -- A periphery frame, 10,101 / -- Bearing, 11,111 / -- An end bracket, 12 / -- A permanent magnet insertion hole, 13 / -- 41 An insulating material, 42 / -- Stator winding salient pole.] -- A dynamo-electric machine, 2 -- A stator, 3 -- A rotator, 4

[Translation done.]

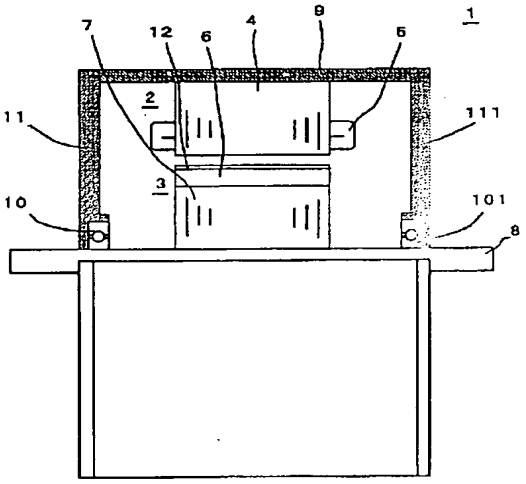
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

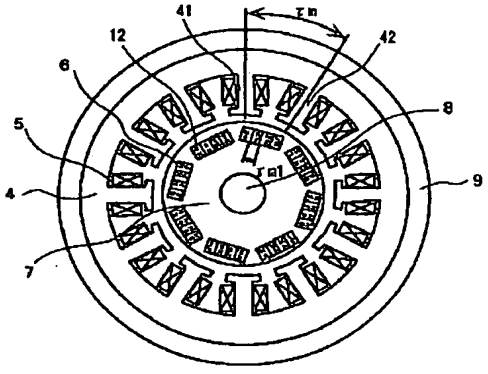
[Drawing 1]

図 1



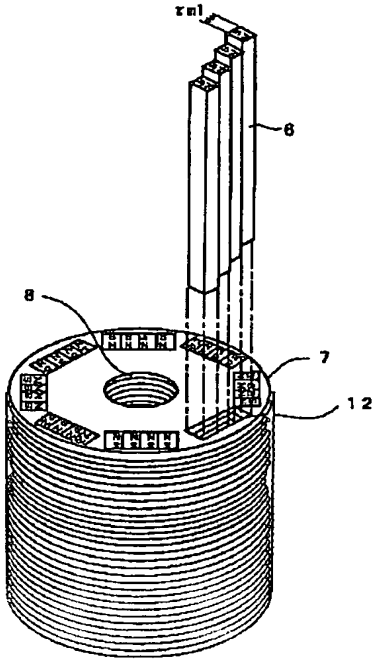
[Drawing 2]

図 2



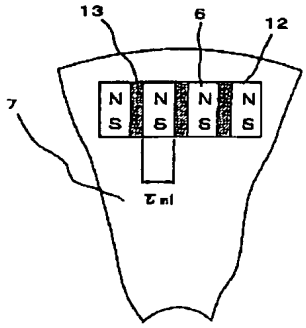
[Drawing 3]

図 3



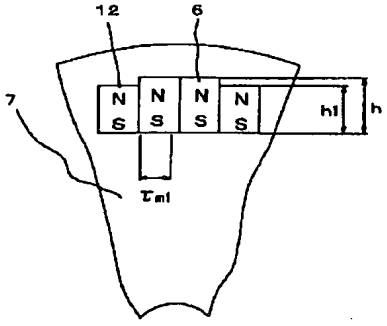
[Drawing 4]

図 4



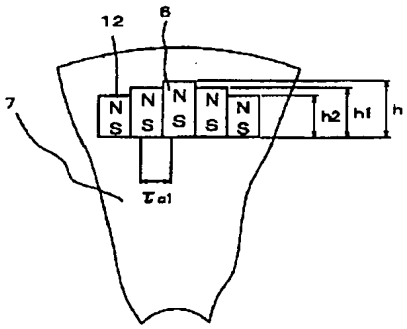
[Drawing 5]

図 5



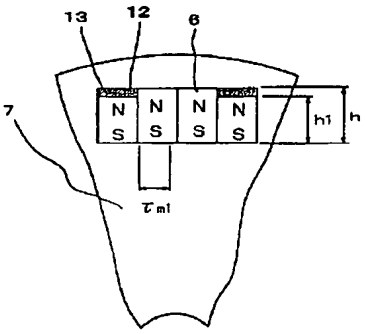
[Drawing 6]

図 6



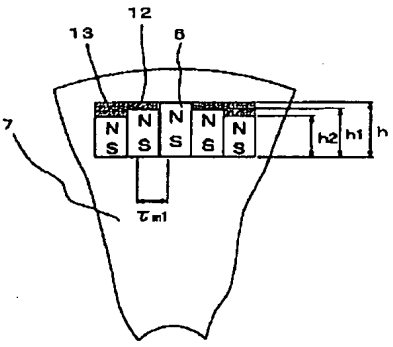
[Drawing 7]

図 7



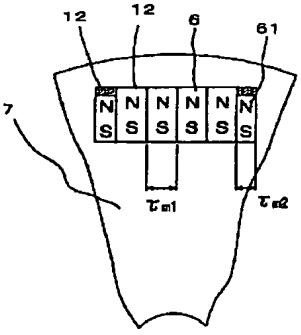
[Drawing 8]

図 8



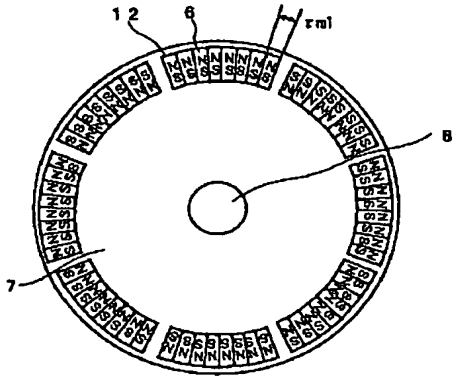
[Drawing 9]

図 9



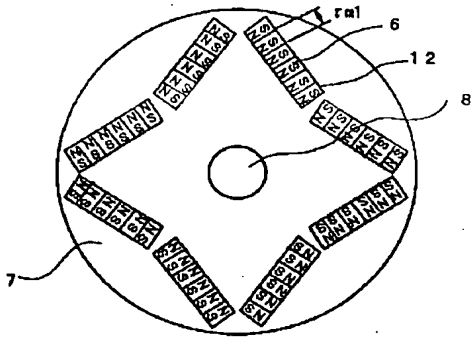
[Drawing 10]

図 10



[Drawing 11]

図 11



[Translation done.]